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A multi-stage validation study to assess an OHS leading indicators tool: Final report

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With regard to the IWH-OPM and the OPM-Monash University:

Table of Contents

The OHS leading indicators project

What is the OHS leading indicators project?

Leading indicators of occupational health and safety (OHS) can be defined as measures of the positive steps that organisations take that may prevent an OHS incident from occurring. The OHS leading indicators project is a large research project that has been conducted by a research team at Monash University in partnership with WorkSafe Victoria, the Institute for Safety, Compensation and Recovery Research (ISCRR), the safesearch Executive GM Safety forum (GM Forum) and Safe Work Australia.

Key results of the project

The OHS leading indicators project has identified and adapted a measure of leading indicators of OHS, the Organizational Performance Metric-Monash University (OPM-MU) that can be used as a 'pulse check' of OHS leading indicators for workplaces in Australia.

- The OPM-MU has been validated in research conducted with employees and managers in 66 workplaces across six industries (n = 3,605) and members of two unions (n = 9,641). Results show that the OPM-MU is a valid and reliable measure of OHS leading indicators.
- Higher scores on the OPM-MU are associated with
  - more positive employee safety behaviours such as compliance with safety rules and the promotion of safety in the workplace;
  - fewer OHS incidents and near misses; and
  - a reduction in lost-time, medical-treatment and total recordable injury frequency rates three months after administration of the OPM-MU.

The OPM-MU is a versatile instrument that works well both across and within organisations such that scores on the OPM-MU can be used to assess differences in perceptions of OHS leading indicators.

Comparisons of scores on the OPM-MU can be made between

- organisations within an industry or across multiple industries;
- workplaces within an organisation
- employee levels of seniority or employee job categories; and
- employees working in different organisations but within the same professional context such as union members.

The surveys conducted in this project were extensive and included additional analyses beyond the evaluation of the OPM-MU that was the central theme of this project. Detailed reporting of the project beyond the basic validation of the OPM-MU, is not within the scope of this brief report. For further details on these studies, see the list of reports in Appendix 1.

Stakeholder outcomes

Outcomes for the OHS Leading Indicators Project have been extensive and overall outcomes for key stakeholders are summarised below:

- The project has raised awareness of OHS leading indicators within government as well as across the broader business and academic communities. The researchers have engaged government, business and academic communities by participating in conferences and invited talks with government, industry and trade union groups.
- The researchers have delivered extensive formal communications about the research findings to key stakeholders, including
  - the provision to WorkSafe Victoria and ISCRR of reports on each stage of the project as part of the agreed key performance indicators for the project and additional reporting as requested.
  - a customised report provided to participating organisations comparing the performance of their workplaces on OHS leading indicators.
  - a benchmarking report provided to participating organisations that compares the performance of their workplaces on OHS leading indicators to the workplaces of other participating organisations.
  - a customised report that examines perceptions of OHS leading indicators in member workplaces provided to participating unions. These reports also included research outcomes for other issues that were of interest to each union such as occupational violence and aggression (Australian Nursing and Midwifery Federation) and workplace stress (Australian Education Union).
  - a benchmarking report that compares perceptions of OHS leading indicators in member workplaces provided to WorkSafe Victoria and participating unions.
  - a benchmarking report that compares perceptions of OHS leading indicators in public hospitals and aged care facilities workplaces provided to WorkSafe Victoria and participating unions.

Several academic outputs have been completed or are currently in progress, including peer-reviewed academic journal articles and presentations at Australian and international academic conferences.

The OPM-MU has been included in other studies being undertaken by members of the research team. These studies include two projects supported by WorkSafe Victoria:

- a trial of the OPM-MU and an Inspector Checklist for OHS leading indicators; and
- the WorkHealth Improvement Network Evaluation Research Program.

A list of publically available reports, academic publications and presentations is shown at Appendix 1.

In addition, several other researchers have expressed interest in including the OPM-MU in their studies. Overall, this research will contribute to awareness-building for OHS leading indicators and will deliver further testing and validation of the OPM-MU.

Opportunities for further development

OHS leading indicators constitute an important workplace construct that this project has developed and promoted within the wider community. There is substantial social value to be gained from wide-spread uptake of the OPM-MU as an exemplar of this construct and it is important therefore to augment knowledge of, and access to, the OPM-MU.

The continued promotion of OHS leading indicators would be enhanced by setting up a web-based tool and a host framework and database that could allow for ongoing use and analysis of the OPM-MU. It is envisaged that such an approach would be a cost effective way for organisations to evaluate the performance of their workplaces on OHS leading indicators. It would also have the potential to create a central database of scores on the OPM-MU and associated lagging metrics for benchmarking purposes. Specifically, a web-based tool would enable

- organisations to have easy access to the OPM-MU for their internal use with the design of a standardised delivery for the OPM-MU (or a range of delivery modes);
- Monash University to continue data collection, analysis and reporting for benchmarking purposes across industries and over time; and
- the compilation of a de-identified database on the OPM-MU that can summarise performance across organisational characteristics (e.g., size), region and industries with the development of norms for each industry.

Although we have preliminary benchmarking within the study samples, comprehensive benchmarking requires industry uptake on a larger scale.

- To date the OPM-MU has been tested with respondents from seven of the 19 Australian and New Zealand Standard Industrial Classification (ANZSIC) industries. Ideally, a larger study could be conducted to continue collecting data from new workplaces not only in the industries that have already participated, but also from workplaces in other industries. A comprehensive study of this nature would enable the establishment of norms for each industry for the purpose of benchmarking organisations within their industry.
- Data from this study were collected in medium-to-large organisations. Future research could investigate whether the OPM-MU is applicable in small businesses.

The web-based tool and database would enhance the potential to track changes over time via repeated use of the OPM-MU, and the development of benchmarking norms provides important context for organisations to assess their OHS performance. Both of these initiatives would facilitate the development of important action points for organisations in order to improve their OHS performance.

Conclusion

Overall, this research has contributed to a better understanding of OHS leading indicators and the relationships between this construct and other elements of OHS such as employee safety motivations and behaviours. The OPM-MU is a short, practical tool for measuring OHS leading indicators. It has demonstrated validity over a range of industries as well as organisational contexts. We see the OPM-MU as a practical tool that can be used to evaluate OHS leading indicators across a range of settings such as workplaces or professional groups and its brevity allows for it to be included in large scale academic or organisational surveys.

1. Background

1.1. The Monash University OHS leading indicators project

The OHS leading indicators project is a large research project that has been conducted by Monash University in partnership with WorkSafe Victoria (WSV), the Institute for Safety, Compensation and Recovery Research (ISCRR), the safesearch Executive GM Safety forum (GM Forum), and Safe Work Australia. The project began in 2012 when the Monash University research team conducted preliminary research that identified and piloted a tool that was developed in Canada to measure OHS leading indicators (the Organizational Performance Metric or OPM) which is known as the IWH-OPM. Since then, the research team has conducted several large scale survey studies that have validated an adapted version of the OPM in the Australian context.[1, 2] This adapted version is known as the Organizational Performance Metric-Monash University (OPM-MU).

This initial study was a review of the literature on leading indicators of occupational health and safety (OHS) and a search for validated tools that measure this construct. The purpose of the review was to determine the availability and quality of tools that could be used to obtain a preliminary measurement of leading indicators of OHS performance. Each tool sourced for this review was evaluated on the basis of the psychometric analysis conducted: latent structure (e.g., exploratory factor analysis) and validity (content, convergent, discriminant and criterion) as well as reliability (internal consistency). As the outcome of this review was to confirm that the IWH-OPM was the only measure developed and validated to specifically evaluate the presence of OHS leading indicators in workplaces, the remainder of the leading indicators project was dedicated to evaluating the OPM-MU.

The research was conducted in three different contexts. Initially, the IWH-OPM was trialled in a workplace survey using only single informants from one of three groups; OHS managers, health and safety representatives (HSR) or non-OHS personnel. Interviews were conducted with stakeholders in OHS in Australia and New Zealand. As a result of this process, modifications were made to the IWH-OPM resulting in a modified version which is known as the OPM-Monash University (OPM-MU).

The OPM-MU was evaluated in a survey of six organisations where the surveys were administered across 66 workplaces (each being a single worksite of the organisation) and data were collected from multiple informants at each workplace within the relevant organisation. In this stage of the project we administered two questionnaires, one at manager level and the other at the employee level. The final component of the project was to administer questionnaires to union members of two large Victorian unions within the health and education fields. Additionally, there is ongoing research investigating the relationships between workplace scores on the OPM-MU and WSV inspector's workplace ratings as well as other research projects investigating work health and wellbeing.

1.2. What are OHS leading indicators?

Leading indicators of OHS performance can be defined as measures of the positive steps that organisations take that may prevent an OHS incident from occurring. Baker and colleagues defined leading indicators as "A metric that attempts to measure some variable that is believed to be an indicator or precursor of future safety performance."[3] In other words, leading indicators can be said to measure the 'safety potential' of a workplace. Leading indicators are the key to a proactive approach to OHS and the measurement and monitoring of OHS performance. Leading indicators are, by definition, measures of the predictors or root causes of OHS performance.[4, 5] Leading indicators can provide effective early warnings, by enabling risks or risk increases to be detected and mitigated, before an OHS incident occurs or a hazardous state is reached.

OHS leading indicators may be at a broad, macro-level (e.g., presence of OHS policy), and/or they may be more specific (e.g., number of hazards identified each month). Macro-level indicators may be able to be applied across workplace and industry contexts in order to benchmark and obtain a broad and comparable overview of OHS. These may be complemented by more specific and sensitive micro-level indicators that allow for a fine-grained understanding of OHS performance in a particular work context or organisation. There is recognised value in both macro and micro-level indicators of OHS performance.

Research on leading indicators has grown in recent years with contributions from a range of sectors including academia, industry, and government.[5-7] Sinelnikov, Inouye and Kerper. (2015: 240)[5] recently noted that "a general consensus exists for the use of leading indicators as a measure of OHS performance." On the basis of our literature review we have summarised the major themes of the OHS leading indicators construct which are shown in Table 1. This list of the dimensions or domains of leading indicators is representative rather than exhaustive and it is important to recognise that each domain is complex and detailed.

Table 1: Leading Indicators of Occupational Health and Safety

OHS Leading Indicators	
OHS systems (policies, procedures, practices).	These systems refer to workplace policies, processes and practices designed to control and monitor OHS, and are typically implemented and maintained by managers and in work groups.[4]
Management commitment and leadership	As with any organisational initiative, management commitment is key to OHS.[6, 8] This includes managers at all levels, from board and senior executive levels to front-line supervisors. Effective commitment is demonstrated in active engagement in areas such as information gathering about OHS, building trust so all employees view managers as committed to OHS, managers' behaviour demonstrating that they are OHS role models; and managers demonstrating that OHS is a high priority across the organisation.
OHS training, interventions, information, tools and resources	Along with the resourcing of OHS with suitably qualified OHS specialist expertise, the provision of OHS training, information, tools and resources are key leading indicators of OHS performance.[6] This includes preparedness to act and having a response plan in place.
Workplace OHS inspections and audits	A phrase often attributed to management scholar Peter Drucker: is "*What gets measured, gets managed*." An important implication of this is that the conduct of an audit or inspection may not in itself be adequate as a leading indicator of OHS performance. Inspections and audits should be designed to provide appropriate and comprehensive information.[9] Appropriate and timely corrective action should be taken to address issues identified in audits or inspections.
Consultation and communication about OHS	This refers to regular, formal and informal communication and consultation about OHS.[10] Employee surveys may be one way of gathering information from employees regarding their perceptions of OHS.
Prioritisation of OHS	The tendency for safety to be traded off against productivity has been discussed at length by OHS academics.[11] Rather than view safety and productivity as competing goals, OHS embedded in the organisation as a high priority alongside efficiency and productivity can be viewed as a leading indicator of OHS performance.
OHS empowerment and employee involvement in decision making	It is widely understood that employee involvement in decision making will lead to 'ownership' of their behaviour and positive outcomes, such as safety behaviour.[12] Several researchers have investigated the role of empowerment and engagement in OHS and found that empowerment of workers and supervisors to make decisions with regard to OHS (e.g., to stop work that is unsafe) is a leading indicator of OHS performance.[13]
OHS accountability	A workplace culture that emphasises a sense of shared responsibility and accountability for OHS, by actively applying scrutiny and transparency in reporting, is likely to influence behaviour in the workplace.[14]
Positive feedback and recognition for OHS	It is suggested that high performance on OHS will be reinforced by positive feedback and recognition for past performance. Such recognition should not, however, include rewards that might lead to under-reporting of incidents or injuries.[15]
Risk management	This refers to the integration of risk management with the management of OHS.[16] Aspects of risk management include risk assessment, control, inspection and maintenance.[17] Risks may be associated with psychosocial, physical and/or physiological dimensions of OHS.

1.3. Selecting a measure of OHS leading indicators

While the importance of identifying and measuring leading indicators of OHS performance has been recognised by OHS academics and professionals, there has been a paucity of research focused on the measurement of OHS leading indicators. The review was conducted with a view to selecting a tool that was

- developed to measure OHS leading indicators;
- psychometrically sound (i.e., reliability, validity);
- a generic measure that could be administered across industries and job roles; and
- a short, easy to administer tool to be of practical use in a variety of research settings (e.g., larger surveys).

The results of our review indicated that there was only one tool that had been developed specifically to measure OHS leading indicators, although there were tools that addressed the underlying domains that were speculated to be part of the OHS leading indicators construct. These tools included multi-item scales to measure safety management systems, safety culture and safety climate scales and other scales that tapped the safety component of organisational policies and practices. The literature review revealed that the most prevalent practices measured in extant safety scales were communications between management and employees; employee motivation; documentation, policy and procedures; management commitment and leadership; safety over productivity; preparedness; and employee training.

In addition to measuring the OHS leading indicators construct, we wanted to select a scale that had been validated to a reasonable level, could be administered across industries and job roles and was easy to administer. The review identified a range of scales that had been developed and validated to an acceptable level (i.e., reliability and validity analysis) and the OPM was identified as having superior psychometric properties (i.e., latent structure, reliability, construct validity).

The review concluded that the OPM was the most suitable scale to use for the OHS leading indicators project. While other scales had been found to address leading indicators of OHS, there were some drawbacks. These drawbacks included the fact that not all of the reviewed scales have been validated to an acceptable level. However, of those scales that had been validated, many had been developed for, or validated in, industry-specific surveys and would require revisions as well as additional validation. Further, some were lengthy and therefore may be cumbersome to administer as part of a larger survey. Overall, while several scales were identified that met one or more of the specified criteria, the OPM was the only measure identified in the review that adequately met all four of the criteria required for the OHS leading indicators project.

1.4. Aims of this report

The aim of this report is to summarise the main outcomes of the OHS leading indicators project. Specifically, this report will discuss the evaluation of, and revisions to, the OPM as a result of the preliminary study across workplaces within Victoria, using single informants with varying levels of OHS experience (OHS managers, employee health and safety representatives and non-OHS personnel).

While the analyses conducted were extensive in some instances (e.g., the ANMF study) the focus of this report will be to summarise the evaluation of the OPM and discuss revisions

made to the OPM as a result of the surveys conducted during the project. The most significant changes to the OPM were made after the first survey of workplaces where it was recognised that the response options and the wording of some items could be improved.

The report continues the evaluation of what we now call the OPM-MU that was conducted in

- a national study of workplaces from six organisations where the OPM-MU was evaluated in a multi-level study and examined using both employee and workplace outcomes.
- the context of professional associations where the OPM-MU was evaluated with the Victorian branch members of two unions, the Australian Nurses and Midwifery Federation (ANMF) and the Australian Education Union (AEU).

Conducting multiple studies enabled the research team to extend our understanding of the OPM-MU and how it performs in different contexts. The outcomes of this project have been to provide a comprehensive study of the OPM-MU and examine its place within a framework of other OHS and lagging OHS metrics.

The intent of this report is to summarise the project outcomes in general, rather than provide specific details for each study. For more detailed information on each study, we refer readers to the individual project reports on our website. A list of published reports can be found in Appendix 1.

2. OHS leading indicators project design

The OHS leading indications project was developed in consultation with the primary stakeholders to develop a framework in which to test the IWH-OPM and subsequently the OPM-MU. As a multi-stage project, procedures, the sample and the type of analysis varied across the life of the project. The overall approach taken in this project from the initial stages of the literature review and stakeholder interviews through to the workplace surveys has allowed the research team to conduct a comprehensive study of both the IWH-OPM and the OPM-MU. The OHS leading indicators project employed standard procedures for the development and evaluation of a scale from preliminary development to the workplace surveys in multiple samples. Key features of the research included

- content validity: literature review and stakeholder interviewers;
- factor structure/dimensionality: exploratory factor analysis and reliability analysis, Rasch model analysis;
- construct validity: correlational analysis with other measures of OHS and employee safety behavior; and
- criterion validity: employee self-reports of OHS outcomes, lagging metrics of OHS from workplace OHS managers and claims data.

2.1. Preliminary development

The initial stages of the project focused on sourcing a measure of OHS leading indicators and establishing the content validity of that scale. This was a two stage process with the literature review conducted to find the most suitable measure of OHS leading indicators and stakeholder interviews to assess content validity.

2.1.1. Literature review

The search for validated instruments that addressed the OHS leading indicators construct was conducted through both academic literature and grey literature searches from January 2000 to May 2012. The databases that were searched for measures of OHS leading indicators were Business Source Complete, EMBASE, PsychInfo, and Emerald and Science Direct. Follow-up searching was conducted through table of content searches and reference lists of articles found in the database search. The search of grey literature included websites that focused on OHS in Australia including Safe Work Australia, Safety Institute of Australia (SIA), Work Cover NSW, WorkSafe Victoria and Work Safe WA. We also searched international websites including Health & Safety Executive (Great Britain), Institute of Work & Health (Canada), National Institute of Safety & Occupational Health (USA), International Labour Organisation, SAI Global and the World Health Organisation.

For scales to be included in this review, they were required upon initial reading to address the specified criteria to some extent: that is, each scale should address the construct of leading indicators of OHS performance; measure OHS performance at the workplace level; and contain a series of Likert-style items. Studies were generally excluded from the review if scale items were specifically targeted at the employee level of analysis or if they investigated OHS leading indicators through extensive surveys. Studies that did not present their items

as a well-defined scale were also excluded (e.g., Geldart, Smith, Shannon & Lohfield, 2010; Marsical, Herrero & Otero, 2012).[18, 19]

Few scales designed to measure leading indicators of OHS performance at the employer level were found in the literature. Therefore, we included employee focused scales if the language of the items was generic and referred to organisational safety practices rather than employee safety behaviours. Some employee scales were included if their items could be readily adapted to a management level scale without sacrificing the meaning of the items.

Finally, to assess the utility of each scale found we examined each article to determine whether the authors had reported the origin and development of the items in their scale (content validity); analysis that examined the underlying structure of their scale (latent structure); Cronbach's alpha of their scale (reliability); and correlations to other external constructs that are both conceptually related and unrelated; or confirmatory factor analysis to examine the distinctiveness of the constructs used in their study (construct validity).

2.1.2. Stakeholder interviews

A total of 53 stakeholder interviews were conducted with employer representatives, union representatives, representatives of state, Australian and international governments and regulators, independent consultants and service providers, and academics. Interviewees were selected on the basis of their expertise and experience and to obtain a variety of perspectives.

Interviews (ranging in length from 35 minutes to one and a half hours) were conducted face-to-face or by telephone in 2012 and 2013. Interviews were conducted in three stages in June-July 2012, November-December 2012 and April-December 2013. Respondents self-selected their participation based on an explanatory email invitation. A total of 65 people were invited to participate in an interview. Twelve people were either unavailable or did not respond to the invitation. Assurances of confidentiality were given to interviewees and no individual interviewee or organisation are identified in this report.

Semi-structured cognitive interviews were conducted. First, the interviewer provided a brief background to the project. Second, the interviewees were asked to outline their experience relevant to OHS. Third, interviewees were asked for their views on lead and lag indicators of OHS and for their views on the OPM. Finally, any additional comments were sought. Both general and specific questions were posed in the interviews. The interview questions were developed based on the literature review and piloting with academic colleagues. Additional probing questions were used to follow up points raised by interviewees, for clarification and for further information.

2.2. Workplace surveys

The research team ran three surveys for the OHS leading indicators project between September 2012 and January 2015. Table 2 below summarises the scope of the surveys for each stage of the project and shows the transition in focus from the original OPM (IWH-OPM) to the adapted version re-labelled as OPM-Monash University (OPM-MU).

Table 2: Summary of surveys

	Study 1	Study 2	Study 3
Which tool was assessed?	IWH-OPM	OPM-MU	OPM-MU
What methods were used?	Computer assisted telephone interviews and online surveys	Paper and online surveys	Online surveys
How many workplaces were included?	4,883 Victorian workplaces	66 Australian workplaces	Not workplace-based. All members of the Victorian branches of two unions were invited to respond.
What was the response rate?	30%	35%	7% in each union
Which industries were included?	All ANZSIC industries	Six ANZSIC industries	Two ANZSIC industries
Who responded?	One person per workplace (n = 1,444) who were • OHS managers; • HSRs; or • other personnel.	Multiple respondents per workplace (n = 3,605) who were • managers; or • employees.	Union members (n = 9,641)

The first study of the OPM was conducted with single informants using the original IWH-OPM (IWH, 2011; 2013).[20, 21] We modified the percentage response options to ensure they did not contain the overlapping categories of the original version (0%-20%, 20%-40%, 40%-60%, 60%-80%, 80%-100%). However, a substantial ceiling effect was observed during this stage of the project where a large percentage of respondents selected the top response category for nearly all items. The response options for the IWH-OPM were altered from percentage (0%-20%, 21%-40%, 41%-60%, 61%-80%, 81%-100%) to Likert response options (1 = strongly agree to 5 = strongly disagree). In Study 2, after discussions across stakeholder groups, the wording of the IWH-OPM items were altered to address both health and safety rather than focus just on safety. Study 3 drew from members of two unions who represented employees across a range of worksites. In this study we sought the views of individuals who were employed across multiple worksites but were employed in the same professional context. Table 3 below summarises the content for each survey.

Table 3: Summary of survey measures in each research stage

Measures included	Study 1	Study 2	Study 3
Background information	Demographics Workplace descriptors	Demographics Workplace descriptors	Demographics Workplace descriptors
OHS leading indicators and other included measures	IWH-OPM Organizational Policies & Practice (OPP-11) Corporate Social Responsibility (employee)	OPM-MU Safety climate Safety motivation Safety compliance Safety participation Safety control Role overload OHS leadership Perceived risk at work	OPM-MU Safety climate Safety motivation Safety compliance Safety participation Safety control Role overload OHS leadership Supervisor support Prioritisation of OHS Perceived risk at work
OHS outcomes	WorkCover claims and notices given for • 3 years prior to survey administration; and • 1 year following study participation Claims were recorded as • stress • musculoskeletal disorders • other injuries Injuries with • 4 weeks' time loss • 13 weeks' time loss Notices recorded • Voluntary compliance • Improvement • Prohibition	OHS incidents that were self-reports from employees OHS incidents that were workplace reports from the OHS manager Lost-time injury frequency rate (LTIFR) Medical treatment injury frequency rate (MTIFR) Total recordable injury frequency rate (TRIFR)	OHS incidents that were self-reports from union members
Additional workplace context measures	Workplace size Employer type Union membership Written commitment to safety	Workplace size Employee type (e.g., summary of full-time, part-time etc.)	Additional variables that were included and were specific to each union context e.g., burnout and occupational violence & aggression

3. OHS leading indicators project results

3.1. Literature review

The search of academic and grey literature relevant to leading indicators of OHS sourced 21 safety scales that addressed the OHS leading indicators construct. These measures were evaluated and compared to the IWH-OPM on the basis of their content, convergent, discriminant and criterion validity. While only one scale (the IWH-OPM) was developed to specifically represent the OHS leading indicators construct, a range of scales were found that address this construct or some dimensions of it. An evaluation of the psychometric properties of the scales sourced indicated that the IWH-OPM was evaluated to an acceptable level and was concise and easy to administer. In sum, the IWH-OPM was the most suitable and reliable scale for the purpose of the OHS leading indicators project.

On the basis of this review, the primary recommendation was that the IWH-OPM be validated in a sample of Victorian workplaces. Alternative recommendations, of adapting an existing scale or developing a new scale, were also presented; however, as the initial literature review identified the IWH-OPM as a theoretically sound and practical measure of leading indicators and substantiated the IWH-OPM, it was used as a starting point for the research.

3.2. Stakeholder views of OHS leading indicators

A total of 53 interviews were conducted in 2012 and 2013 to provide background context for the quantitative development of the OPM-MU. The views of key stakeholders were subsequently taken into account in the survey design in Study 2. Interviewees were selected on the basis of their expertise and experience and to obtain a variety of stakeholder perspectives.

The broad research questions for this stakeholder consultation are listed below.

- What are the views of stakeholders regarding OHS lag indicators?
- What are the views of stakeholders regarding OHS lead indicators?
- What are the views of stakeholders regarding the OPM?

The major outcomes from the stakeholder interviews are summarised below.

- The stakeholders/interviewees provided practical information relevant to the workplace, national and international contexts for OHS.
- Stakeholders, particularly employer representatives, identified a range of leading and lagging indicators currently used in their organisations.
- Stakeholders expressed frustration with a reliance on lagging indicators.
- There is consensus among stakeholders that leading indicators are important aspects of OHS performance.
- Stakeholders hold varying views about which leading indicators might be most important to measure and how to measure them.
- There is awareness among stakeholders that leading indicators may be difficult to measure.

- The majority of stakeholders saw value in the idea of a simple, practical measure of leading indicators.
- A minority of stakeholders questioned whether the measurement of leading indicators is valuable and queried whether leading indicators could be measured at a high level.
- Stakeholders identified a range of leading indicators that they view as important.
- Stakeholders expressed diverse views of the IWH-OPM. Overall, most interviewees were consistent in the view that the IWH-OPM is concise, easy to administer, and a suitable scale for the purposes of this project. Numerous suggestions were offered with regard to modifications to be made to the scale.

Overall, the views of stakeholders contributed to the development of the OPM-MU.

3.3. Workplace surveys

The interviews conducted with industry stakeholders in Australia along with further inspection and pilot-testing of the IWH-OPM led us to make several adaptations to the scale. Initially, the OHS leading indicators project examined the performance of the OPM within workplaces using both single and multiple respondents in studies one and two, respectively. Specifically, we examined the psychometric properties of the IWH-OPM (Study 1) and OPM-MU (Study 2) by investigating both

- latent structure as determined by exploratory factor analysis; and
- construct validation by examining workplace scores on the IWH-OPM and OPM-MU in relationship to scores on other OHS variables and contextual features of the workplace.

Study 3 extended the validation of the OPM-MU by examining the performance of the OPM-MU across workplaces. In this study we sought the views of individuals who were employed across multiple worksites but were employed in the same professional context. In this study we surveyed Victorian branch members of two unions, the Australian Nursing and Midwifery Federation (ANMF) and the Australian Education Union (AEU), on the presence of OHS leading indicators in their workplaces.

3.3.1. Workplace surveys using the IWH-OPM

The IWH-OPM was administered in Study 1 to single informants of 1,444 Victorian workplaces. During the course of the study some adaptations were made to the items and the response scale. First, to adequately and consistently address OHS, we replaced ‘safety’ with ‘health and safety.’ Second, we replaced the original response scale that uses percentages [0%-20%, 20%-40%, 40%-60%, 60%-80%] with a Likert five-point scale from strongly disagree (1) to strongly agree (5). This change was necessary to address the substantial ceiling effect observed in the pilot study when we used the percentage response options. Twenty-one percent of workplaces were rated at the highest score of 40, but this ceiling effect was ameliorated somewhat by changing the survey administration mode to online, reducing the ceiling effect to 15 percent.

Figure 1 below shows mean scores across the different survey conditions. When comparing telephone and online surveys, the total IWH-OPM scores tended to be higher when using a telephone survey, indicating a positive response bias when using this method. Figure 1 also provides information about the use of percentage options compared to Likert response options to collect IWH-OPM scores. Results show that there is a tendency for higher scores

when using of the percentage response options compared to Likert response options. Overall, the average (mean) score for the IWH-OPM across all respondents was 33.4 out of a possible score of 40 (SD = 4.2).

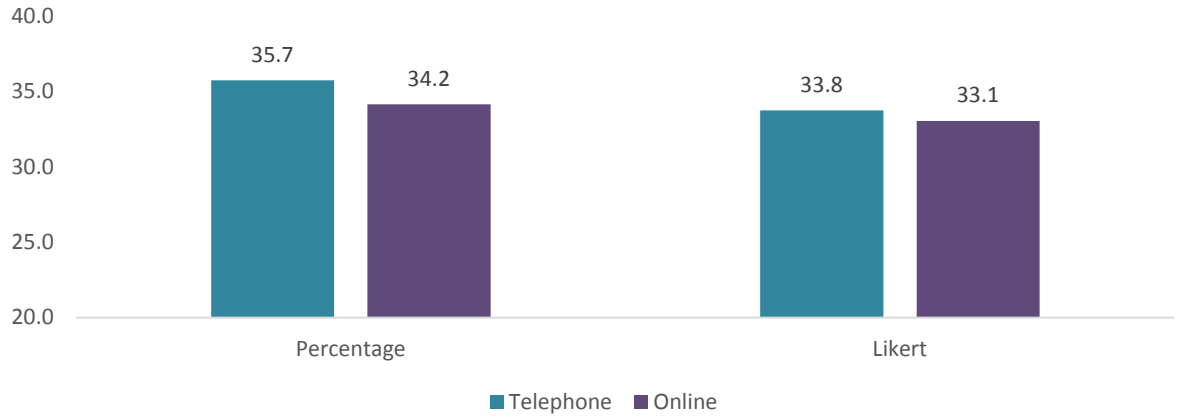

Figure 1: Average IWH-OPM scores across survey conditions

An examination of the latent structure of the IWH-OPM, using the data collected from telephone interviewing, revealed poor factor structure across both percentage and Likert response options. Analysis conducted on the IWH-OPM with data collected using the online method of administration was not optimal, but showed substantial improvement.

Given the problems with model fit associated with both survey methodology and the percentage response options, only the subset of the data collected through the online survey using the Likert response options was used to examine the relationship between the IWH-OPM and other measures of OHS. The associations between workplace scores on the IWH-OPM and other workplace practices were

- stronger for a measure that could be considered a leading indicator of OHS (a measure of 'safety practices');
- weaker for a measure that could be considered a lagging indicator of OHS performance (a measure of 'disability management'); and
- weaker for measures of employee centered constructs that are not directly related to OHS (a measure of 'corporate social responsibility practices' and a measure of 'people oriented culture').

This pattern of associations provides evidence for construct validity of the IWH-OPM. The IWH-OPM was most strongly correlated with another OHS leading indicator (convergent validity) and less strongly correlated with a related but distinct measure, employee specific corporate social responsibility (discriminant validity).

Study 1 also examined the relationship between the IWH-OPM and WorkCover claims as recorded in the WorkSafe Victoria claims database. The relationship between leading indicators (as measured by the IWH-OPM) and WorkCover claims appeared to be complex and results were confounded by methodological issues such as survey administration method where associations were detected in the online survey data but not the telephone survey data. In the online survey:

- higher scores on the IWH-OPM were associated with greater number of total claims in the preceding three years;
- higher scores on the IWH-OPM were associated with greater number of claims classified as 'other' in the preceding three year period; and
- no association was observed between scores on the IWH-OPM and claims in the 12 months following the survey. Although, this relationship might have been attenuated by the short timeframe used in this stage of the study.

The lack of a relationship between scores on the IWH-OPM and WorkCover claims might reflect the fact that WorkCover claims are a relatively distant measure of OHS outcomes. Consequently, we concluded that it would be fruitful to investigate relationships between OHS leading indicators and OHS outcome measures that are collected at the workplace and would be more proximal OHS outcome measures compared to claims data.

3.3.2. Workplace surveys and the OPM-MU

Study 2 adopted the adaptations made to the IWH-OPM for the next stage of the validation process. To prevent confusion with the IWH-OPM, we labelled the adapted version as the OPM-Monash University (OPM-MU). The IWH-OPM was originally validated at the individual informant level through both this current project and also in North America (IWH, 2011, 2013) but the goal of Study 2 was to validate the OPM-MU within workplaces using multiple employee informants from each workplace.

The validation process for Study 2 followed the same pattern as Study 1. We sought to establish construct validity by examining the associations between OPM-MU employee behaviours, motivations and perceptions of the workplace as well as OHS outcomes (e.g., reported incidents, unreported incidents, near misses). We also sought to establish predictive validity by examining the associations between mean scores on the OPM-MU for each workplace and other workplace OHS measures such as lost-time injury rate.

We conducted our analysis on the responses of 3,605 employees in 66 workplaces recruited from six large organisations in Australia. The psychometric evaluation of the OPM-MU using multiple respondents across the 66 workplaces revealed good model fit. The analysis showed that the items of the OPM-MU formed a one-factor scale where the items could be summed to a single score and that the scale had very good reliability ($\alpha = .89$).

The average score for the OPM-MU across all respondents to the survey was 29.0 out of a possible score of 40 (SD = 5.8). The figures below show how total scores on the OPM-MU can vary both across and within organisations and how scores within organisations can be used to assess strengths and weaknesses within an organisation.

Figure 2 displays the scores on the OPM-MU across the six participating organisations. As can be seen in this figure, half of the participating organisations attained a score on the OPM-MU that was greater than the average score for the sample as a whole (purple bars), while the score for Organisation B was substantially lower.

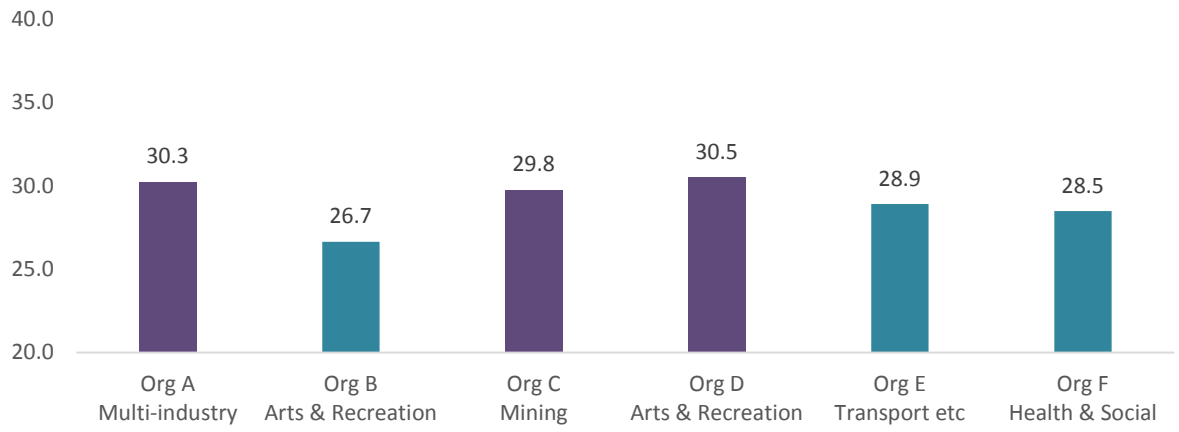

Figure 2: Average OPM-MU scores across organisations

Figure 3 below shows the average OPM-MU scores for workplaces in Organisation B and how scores on the OPM-MU can be used diagnostically within the organisation. The chart for this organisation data revealed a unique situation in Organisation B. Employees who were based in workplaces directly controlled by Organisation B (sites A, B, C, D, H and I) rated their workplaces higher on leading indicators of OHS compared to those employees who were outsourced to externally controlled workplaces (sites E, F and G).

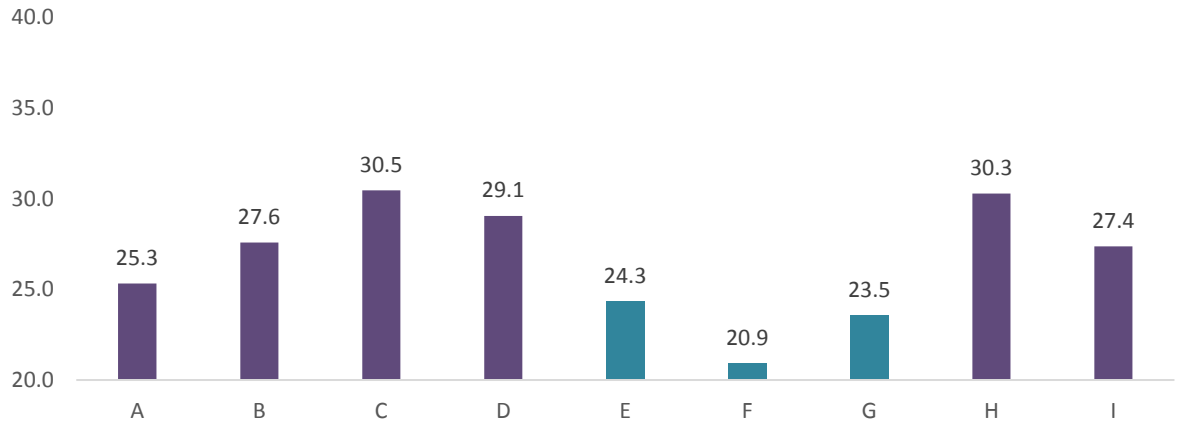

Figure 3: Average OPM-MU scores for workplaces at Organisation B

In Figure 4 scores are compared across respondent levels in the organisation. Average scores on the OPM-MU show that managers tended to rate their workplaces higher than either supervisors or non-supervisory employees. In turn, employees in a supervisory role tended to rate their workplaces slightly higher on the OPM-MU compared to employees who were not employed in supervisory roles.

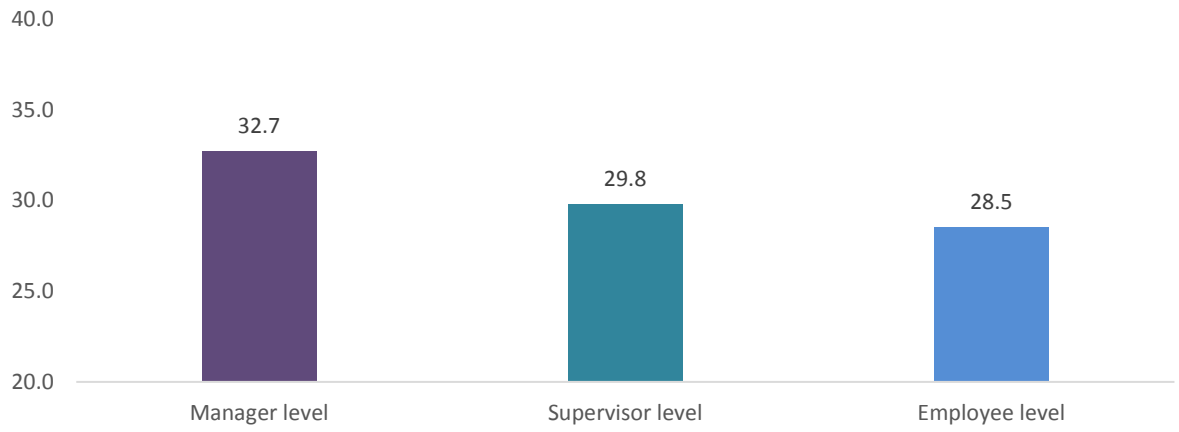

Figure 4: Average OPM-MU scores for level of employment

These ratings of leading indicators (as measured by the OPM-MU) show how scores on the OPM-MU can vary substantially within organisations and indicate that scores are likely to be affected by workplace contexts.

The validation of the OPM-MU was tested using correlational analysis to examine the relationship between the OPM-MU and other measures of OHS. This analysis demonstrated that the OPM-MU is a valid measure of OHS leading indicators, can predict lagging indicators and can be distinguished from other measures of employee level OHS attitudes and behaviours.

The associations between ratings on the OPM-MU and scores on other scales measuring employee motivations and behaviours show that employees who rate their workplaces higher on leading indicators of safety (as measured by the OPM-MU) tended to report that they

- behaved more safely in the workplace;
- have greater levels of safety motivation; and
- have a greater sense of control over their own safety.

Study 2 examined OHS leading indicators (as measured by the OPM-MU) in relation to employee safety behaviours and employees' experience of OHS incidents. Employees who rated their workplaces higher on the OPM-MU also reported that they had higher levels of

- safety motivation;
- safety compliance; and
- safety participation.

Higher workplace scores on the OPM-MU were also associated with fewer

- unreported OHS incidents; and
- near misses.

There was no evidence of an association between the presence of OHS leading indicators and reported OHS incidents (i.e., OHS incidents that were reported by individuals to management).

In Study 2, we also examined the relationship between employee survey responses about the presence of OHS leading indicators (measured by the OPM-MU) and the workplace level

OHS outcomes collected in organisational records three months later. We found that leading indicators (as measured by aggregated OPM-MU scores in each workplace) were associated with workplace injury frequency rates that occurred in the three-month time period following the administration of the phase one survey. Higher scores on the OPM-MU were associated with lower

- lost-time injury frequency rate (LTIFR);
- medical treatment injury frequency rate (MTIFR); and
- total recordable injury frequency rate (TRIFR);

There was no evidence of an association between the presence of OHS leading indicators and OHS incidents collected in organisational records (i.e., OHS incidents, hazards and near misses at the workplace level).

As the OPM-MU is a leading indicator, it does not assess the number of OHS incidents that have occurred in a workplace. Instead, the OPM-MU provides a measure of employee perceptions regarding the value of, and emphasis given to, OHS in their workplace. Workplaces with higher scores on the OPM-MU, therefore, are perceived to be more actively engaged in practices that could reduce the likelihood of OHS incidents. Conversely, workplaces that obtain lower scores on the OPM-MU are perceived to be minimally engaged in initiatives that may reduce the potential of OHS incidents. Key features of the OPM-MU are listed below.

- The OPM-MU measures individuals' views of the 'safety potential' of a workplace.
- Higher OPM-MU scores indicate that individuals are more likely to agree that their workplace has features that should lead to prevention of work-related illnesses and injuries.
- The OPM-MU could be used as an initial 'flag' of leading indicators of OHS in a workplace.

3.3.3. Union surveys and the OPM-MU

Finally, (Study 3 of the OHS leading indicators project was comprised of two industry surveys where members of the Victorian branches of the Australian Nursing and Midwifery Federation (ANMF) and the Australian Education Union (AEU) were invited to participate. Our analysis confirmed earlier results that the items of the OPM-MU formed a one-factor scale where the items could be summed to yield a single score and that the scale had excellent reliability ($\alpha = .91$) in both the ANMF and the AEU samples.

The average OPM-MU scores for members of the ANMF ($M = 27.4$, $SD = 6.7$) and AEU ($M = 27.2$, $SD = 6.7$) were relatively low compared to the average score from the workplace surveys reported in Study 2.

Consistent with the workplace surveys in Study 2, respondent ratings of OHS leading indicators in their workplaces were shown to vary across type of job, type of workplace and employment status in both the ANMF and AEU samples. The findings reveal that the OPM-MU can be used more broadly to determine which segments of workers in a sector might be at risk. For example, it was identified that personal carers (ANMF survey) and TAFE workers (AEU survey) perceived lower levels of OHS leading indicators compared to members in other role types.

While the union surveys confirmed the relationships between OHS leading indicators (as measured by the OPM-MU) and employee safety motivation and behaviour established in Study 2, the surveys also extended our understanding of how OHS leading indicators fit into a framework of other contextual variables that are pertinent to most workplaces. For example higher scores on the OPM were associated with

- prioritised OHS (for staff) at similar levels to patient safety (ANMF);
- more positive perceptions of OHS leadership (AEU); and
- more positive perceptions of supervisor support of OHS (ANMF & AEU).

In Study 3, we investigated relationships between union member perceptions of OHS leading indicators (as measured by the OPM-MU), their own safety motivation and behaviours as well as their experience of OHS outcomes. The data from both the ANMF and AEU surveys were largely consistent with the results of Study 2 and showed that employees who rated their workplaces higher on the OPM-MU also reported that they had higher levels of

- safety motivation;
- safety compliance; and
- safety participation.

Further, members who rated their workplaces higher on the OPM-MU also reported that they had experienced fewer

- reported OHS incidents;
- unreported OHS incidents; and
- near misses.

The surveys conducted in Study 3 were extensive and included analysis of issues of particular interest to people working in the nursing and caring profession or education. Reporting this detailed analysis, beyond the basic validation of the OPM-MU, is beyond the scope of this report. For further details on these studies, see the list of reports in Appendix 1.

4. How to use the OPM-MU

The OPM-MU is an adapted version of the IWH-OPM. Both the IWH-OPM and the OPM-MU are licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (http://creativecommons.org/licenses/by-nc-nd/4.0/). This means that the OPM-MU can be used for non-commercial purposes as outlined below but no changes can be made to this measure. It is also important to remember that all scales that are developed and validated to this extent are done so with specific wording and response options. Changes to any elements of a scale would require further testing to ensure the scale remained valid for its intended purpose. Figure 5 below displays the items of the OPM-MU as they were validated in this project.

Please read each statement carefully and select the number that best shows your views about health and safety at this workplace.

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
1.	Formal OHS audits at regular intervals are a normal part of our workplace*	1	2	3	4	5
2.	Everyone at this workplace values ongoing OHS improvement in this workplace	1	2	3	4	5
3.	This workplace considers health and safety at least as important as production and quality in the way work is done	1	2	3	4	5
4.	Workers and supervisors have the information they need to work safely	1	2	3	4	5
5.	Employees are always involved in decisions affecting their health and safety	1	2	3	4	5
6.	Those in charge of OHS have the authority to make the changes they have identified as necessary	1	2	3	4	5
7.	Those who act safely receive positive recognition	1	2	3	4	5
8.	Everyone has the resources and/or equipment they need to complete their work safely	1	2	3	4	5

***For the purpose of this survey an audit means a formal process of evaluating and reporting on how the workplace manages health and safety in accordance with a recognised standard. Regular means that an audit is repeated at regular intervals, for example, once every year.**

Figure 5: Organizational Performance Metric-Monash University

4.1. Instructions for using the OPM-MU

When administering the OPM-MU it is important to determine what the aims of your survey are and to be specific about the level of analysis you plan to evaluate. For example, important questions include: Are you asking employees about OHS leading indicators in the organisation as a whole or do you wish to be able to compare OHS leading indicators across workplaces or other divisions within your organisation.

The response options to be used with the OPM-MU items are:

1 strongly disagree, 2 disagree, 3 neither agree nor disagree, 4 agree, 5 strongly agree.

Respondent ratings for the items of the OPM-MU sum to a total score that will have a range between 8 and 40. If respondents do not answer all items it will not be possible to obtain a total score on the OPM-MU for those respondents.

Alternatively, it is possible to calculate an average score for individual respondents (sum of all ratings/number of items completed) and this average score will have a range between one and five. In using this method you will be able to calculate scores for those respondents who have some missing data and you will be able to more easily interpret the average score as it is on the same scale as the individual OPM-MU items.

Other important issues include the capture of an appropriate and representative sample and an adequate response rate. If you plan to compare groups then it is important to ensure a standardised process has been followed for delivery of a survey and to have analysis conducted by someone with expertise in survey data analysis. For many reasons, we recommend the use of an expert research groups such as the authors.

4.2. Conditions of use

5. OHS leading indicators project outcomes

Outcomes for the OHS Leading Indicators Project have been extensive and are summarised below.

- The project has raised awareness of OHS leading indicators within government as well as across the broader business and academic communities. The researchers have engaged government, business and academic communities by participating in industry and academic conferences as well as invited talks with industry, government and union groups.
- The researchers have delivered extensive formal communications about the research findings to key stakeholders:
  - WorkSafe Victoria and ISCRR have been provided with reports on each stage of the project as part of the agreed key performance indicators for the project and additional reporting as requested.
  - A customised report was provided to participating organisations comparing the performance of their workplaces on OHS leading indicators.
  - A benchmarking report was provided to participating organisations that compares the performance of their workplaces on OHS leading indicators to the workplaces of other participating organisations.
  - A customised report that examines perceptions of OHS leading indicators in member workplaces was provided to participating unions. These reports also included research outcomes for other issues that were of interest to each union such as occupational violence and aggression (Australian Nursing and Midwifery Federation) and the workplace stress (Australian Education Union).
  - A benchmarking report that compares perceptions of OHS leading indicators in member workplaces was provided to WorkSafe Victoria and participating unions.
  - A benchmarking report that compares perceptions of OHS leading indicators in public hospitals and aged care facilities was provided to WorkSafe Victoria and participating unions.

Several academic outputs have been completed or are currently in progress, including peer-reviewed academic journal articles and presentations at Australian and international academic conferences.

A list of publically available reports, academic publications and presentations can be found in Appendix 1.

The OPM-MU has been included in other studies undertaken by members of the research team. These studies include two projects supported by WorkSafe Victoria:

- a trial of the OPM-MU and an Inspector Checklist for OHS leading indicators; and
- the WorkHealth Improvement Network Evaluation Research Program.

In addition, several other researchers have expressed interest in including the OPM-MU in their studies. Overall, this research will contribute to awareness-building for OHS leading indicators and will deliver further testing and validation of the OPM-MU.

6. Summary and conclusion

The OHS leading indicators project has modified and validated an 8-item measure of OHS leading indicators: the Organizational Performance Metric-Monash University (OPM-MU). The modifications to the IWH-OPM leading to the OPM-MU include modified

- response options where the OPM-MU was rated on a 5-point response scale ranging from 1 *strongly disagree* through to 5 *strongly agree* rather than the original percentage response options;
- wording where the OPM-MU has been altered to ask about 'health and safety' rather than 'safety';
- targets where the OPM-MU was tested using employees from 66 workplaces in six different industries as well as union members from two industries and has shown employees to be a more reliable source compared to other informants; and
- level of analysis where the focus was on the workplace rather than the organisation. This more intensive approach to evaluating the presence of OHS leading indicators in an organisation is valuable because as it can enable organisations to compare within and between workplaces to ascertain areas of strengths and weaknesses.

In both the workplace and union studies the OPM-MU was found to be a valid and reliable measure of OHS leading indicators. Higher scores on the OPM-MU were associated with more positive employee safety behaviours. Workplaces where the principles of OHS leading indicators were espoused were more likely to have employees who complied with safety rules and participated in safety at a higher level, beyond basic compliance. Employees who reported higher levels of OHS leading indicators in their workplaces also tended to report feeling a greater sense of safety control indicating that these employees had greater awareness of safety issues and empowerment to act safely.

Employees who rated their workplaces higher on the OPM-MU also tended to be involved in fewer unreported incidents and fewer near misses, but not fewer reported OHS incidents. This pattern of associations suggests that when the underlying principles of the OPM-MU are enacted within workplaces, this process might support a more transparent reporting culture. This may explain the finding of fewer reported OHS incidents.

This relationship between the OPM-MU and injury was also confirmed at the workplace level whereby higher scores on the OPM-MU were associated with a reduction in lost-time, medical-treatment and total recordable injury frequency rates three months later. This is an important finding because it indicates that the findings of the self-report data in Study 2 and Study 3 are unlikely to be the result of common method bias.

6.1. Opportunities for further development

OHS leading indicators is an important workplace construct that this project has developed and promoted within the wider community and there is substantial social value to be gained from wide-spread uptake of the OPM-MU as an exemplar of this construct. The continued promotion of OHS leading indicators would be enhanced by setting up a web-based tool and database that could allow for ongoing use of the OPM-MU.

It is envisaged that such an approach would be a cost effective way for organisations to evaluate the performance of their workplaces on OHS leading indicators. It would also have the potential to create a central database of scores on the OPM-MU and associated lagging metrics for benchmarking purposes. Specifically, a web-based tool would enable

- organisations to have easy access to the OPM-MU for their internal use with the design of a standardised delivery for the OPM-MU (or a range of delivery modes);
- Monash University to continue data collection, analysis and reporting for benchmarking purposes across industries and over time; and
- the compilation of a de-identified database on the OPM-MU that can summarise performance across organisational characteristics (e.g., size), region and industries with the development of norms for each industry.

Although we have preliminary benchmarking within the study samples, comprehensive benchmarking requires industry uptake on a larger scale.

- Presently the OPM-MU has been tested with respondents from seven of the 19 ANZSIC industries. Ideally, a larger study could be conducted to continue collecting data from new workplaces not only in the industries that have already participated, but also from workplaces in other industries. A comprehensive study of this nature would enable the establishment of norms for each industry for the purpose of benchmarking organisations within their industry.
- Data from this study were collected in medium-to-large organisations. Future research could investigate whether the OPM-MU is applicable in small businesses.

The web-based tool and database would enhance the potential to track changes over time via repeated use of the OPM-MU, and the development of benchmarking norms provides important context for organisations to assess their OHS performance. Both of these initiatives would facilitate the development of important action points for organisations in order to improve their OHS performance.

6.2. Conclusion

Overall, this research has contributed to a better understanding of OHS leading indicators and the relationships between this construct and other elements of OHS such as employee safety motivations and behaviours. The OPM-MU is a short, practical tool for measuring OHS leading indicators. It has demonstrated validity over a range of industries as well as organisational contexts. We see the OPM-MU as a practical tool that can be used to evaluate OHS leading indicators across a range of settings such as workplaces or professional groups and its brevity allows for it to be included in large scale academic or organisational surveys.

7. References

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Appendix 1
Outputs from the OHS leading indicators project

Reports (All reports are available at http://ohsleadindicators.org/)

De Cieri, H., Shea, T., Cooper, B., Sheehan, C., & Donohue, R. 2016. *A multi-stage validation study to assess an OHS leading indicators tool in workplaces: Final report.* Report prepared for ISCRR and WSV. Monash University, report no. 045-0316-R11: Caulfield East VIC Australia.

Shea, T., De Cieri, H., Sheehan, C., Donohue, R., & Cooper, B. 2016. *Occupational health and safety issues for aged care workers: A comparison with public hospital workers.* Report prepared for ISCRR and WSV. Monash University, report no. 045-0316-R10: Caulfield East VIC Australia.

De Cieri, H., Shea, T., Cooper, B., Sheehan, C., & Donohue, R. 2015. *Early indicators of workplace injuries and accidents: An analysis of leading indicators as predictors of workplace OHS outcomes in Australian workplaces.* Report prepared for ISCRR and WSV. Monash University, report no. 045-0415-R09: Caulfield East VIC Australia.

De Cieri, H., Shea, T., Cooper, B., Donohue, R., & Sheehan, C. 2015. *Early indicators of injuries and accidents at work: An analysis of leading indicators as predictors of WSV data for Victorian workplaces*. ISCRR report number: 045-0415-R08. Monash University: Caulfield East VIC Australia.

De Cieri, H., Shea, T., Donohue, R., Sheehan, C. & Cooper, B. 2015. Leading indicators of occupational health and safety: A report on a survey of Australian Education Union (Victorian Branch) members. ISCRR report number: 045-0415-R07. Monash University: Caulfield East VIC Australia.

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De Cieri, H., Shea, T., Sheehan, C., Donohue, R., & Cooper, B. 2016. *Safety climate, occupational health and safety leadership and workers' engagement with safety: Comparison of survey responses in two unions*. Report prepared for ISCRR and WSV. Monash University, report no. 130-0915-R01: Caulfield East VIC Australia.

De Cieri, H., Shea, T., Pettit, T., & Clarke, M. 2012. *Measuring the leading indicators of occupational health and safety: A snapshot review.* Report prepared for ISCRR and WSV, report no. 0612-045-R1. Monash University: Caulfield East VIC Australia.

Presentations

De Cieri, H. May 12 2016. *Safety culture and safety climate in healthcare.* Webinar for WorkSafe Queensland.

De Cieri, H. April 14 2016. *Introduction to safety culture and safety climate.* Webinar for WorkSafe Queensland.

De Cieri, H. November 12 2015. *Leading indicators of occupational health and safety: Developing a practical measure.* Presentation to Finance Industry Group, hosted by Westpac Bank, Sydney.

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